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EXAMINER	
AHMED, SALMAN	
ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/816,378	Applicant(s) LEE, CHUNG-CHIEH	
	Examiner SALMAN AHMED	Art Unit 2419	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12/4/2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,5-25,28-30,34-54 and 58-78* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 5-25, 28-30, 34-54 and 58-78* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01 April 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claims 1, 5-25, 28-30, 34-54 and 58-78 are pending.

Claims 1, 5-25, 28-30, 34-54 and 58-78 are rejected

Drawings

1. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the "dynamically determining a time epoch based on the loading condition" and "transferring, at the dynamically determined time epoch" must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner,

the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1, 5-25, 28-30, 34-54 and 58-78 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

4. Claim 1, contains limitation "<u>dynamically</u> determining a time epoch based on the loading condition by (i) computing a transmission time to deliver the amount of data in the transmit queue, (ii) computing a system load in units of time by comparing the transmission time to a constant lower limit and selectively setting the system load based on the comparison, and (iii) computing the time epoch based on the system load and a previous time epoch; and transferring, at the <u>dynamically</u> determined time epoch".

5. A text search "dynamic" in originally filed "Specification" yields the following two senctences:

6. "As described herein, downstream scheduler 14 <u>dynamically</u> and fairly allocates bandwidth to active service flows based in part on flow status information associated

with each active service flow….. Time epochs are dynamically determined based on the load of the downstream channel associated with downstream scheduler 14 within CMTS 4, which is determined based on the amount of packet data in a transmit queue within control unit 10."

7. Nowhere in the specification is found the limitation "limitation "dynamically determining a time epoch based on the loading condition by (i) computing a transmission time to deliver the amount of data in the transmit queue, (ii) computing a system load in units of time by comparing the transmission time to a constant lower limit and selectively setting the system load based on the comparison, and (iii) computing the time epoch based on the system load and a previous time epoch; and transferring, at the dynamically determined time epoch." As such, The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Independent claims 25, 30, 54 and 76-78 have similar issues.

8. Claims 5-6 and 34-36 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

9. Claims 5 and 6 state "The method of claim 1, wherein selective setting the system load comprises". However, claim 1 has no limitation stating "selective setting the

system load." As such, claims 5 and 6 are being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

10. Claims 34-36 state "The method of claim 30". However, claim 30 states "A device." As such, claims 34-36 are being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

13. Claims 1, 7-19, 21-25, 28-30, 36, 38-48, 50-54, 60-64, 66-78 are rejected (as best understood by the Examiner) under 35 U.S.C. 103(a) as being unpatentable over

St. John (US2002/0136200) in view of Takase et al., hereinafter Takase, (US PAT PUB 2002/0154649)

Regarding claims 1, 7, 25, 30 and 36 St. John discloses methods, systems and computer program products for bandwidth allocation in a multiple access system (see St. John paragraph 5) program code (see St. John paragraph 22) comprising: • A control unit (see St. John paragraph 31) that stores packets from a variable number of service flows to one of a static number of hold queues (see St. John figure 2 QoS Queues) • storing a packet to one of a plurality of hold queues (see paragraph 5 packets enqueue in the plurality of queues and figure 2 QoS 0 Queue); • monitoring a loading condition of a transmit queue (see paragraph 39 quantum value of a queue is updated) by monitoring an amount of data residing within the transmit queue (see paragraph 39 the packets in that queue may be serviced by first placing them in the output queue); • transferring the packet from the one of the plurality of hold queues to a transmit queue (see paragraph 30) for delivery to a network device via a downstream channel in response to the time epoch (see paragraph 8).

St. John implicitly teaches storing a packet to one of a plurality of hold queues and monitoring a loading condition of a transmit queue by monitoring an amount of data residing within the transmit queue; transferring, at a determined time epoch, the packet from the one of the plurality of hold queues to the transmit queue for delivery to a network device via a downstream channel, but do not explicitly teach storing a packet to one of a plurality of hold queues and monitoring a loading condition of a transmit queue by monitoring an amount of data residing within the transmit queue; dynamically

determining a time epoch based on the loading condition by (i) computing a transmission time to deliver the amount of data in the transmit queue, (ii) computing a system load in units of time by comparing the transmission time to a constant lower limit and selectively setting the system load based on the comparison, and (iii) computing the time epoch based on the system load and a previous time epoch transferring, at the dynamically determined time epoch, the packet from the one of the plurality of hold queues to the transmit queue for delivery to a network device via a downstream channel.

Takase in the same or similar field of endeavor explicitly teaches storing a packet to one of a plurality of hold queues (Figure 1, holding packets in input line processor 16-i) and monitoring a loading condition (i.e. VoQ level) of a transmit queue by monitoring an amount of data residing within the transmit queue (paragraph 0038, Each VoQ level is collected to an arbiter 14 by a signal line 18 during one arbitration period); dynamically determining a time epoch based on the loading condition by (i) computing a transmission time to deliver the amount of data in the transmit queue (If the segment has not existed, the output data interval manager 406 gives an indication to the output data interval counter 411 corresponding to the VoQ so as to add 1 to the numeric value per arbitration period, and manages the output data interval time. In other words, the numerical value which the output data interval counter 411 shows indicate (interpreted as determining step) that how long the segment has not been transmitted from corresponding VoQs), (ii) computing a system load in units of time by comparing the transmission time to a constant lower limit (figure 3, VoQ level assignment matrix 416 is

referred) and selectively setting the system load based on the comparison (Respective ARB-REQ generating parts 409-1 to -4 assign some level to the corresponding queue according to information received from the ARB-REQ generator 13. When the level is assigned to the queue, a VoQ level assignment matrix 416 is referred), and (iii) computing the time epoch based on the system load and a previous time epoch transferring, at the dynamically determined time epoch, the packet from the one of the plurality of hold queues to the transmit queue for delivery to a network device via a downstream channel (paragraphs 0042-0047, The queue length manager 405 increases the length of the segment of the input packet to the numeric value of the queue length counter 410 for the current length of the queue. the WA generator 403 transmits information of the packet which has been written in the input buffer 10 to a queue length manager 405 and an output data interval manager 406. The queue length manager 405 has a queue length counter 410 corresponding to each of all VoQs inside the input buffer 10. FIG. 2 gives the case of a 4.times.4 switch as an example. Since four VoQs exist in the input buffer 10, the queue length manager has four queue length counters 410. The queue length manager 405 increases the length of the segment of the input packet to the numeric value of the queue length counter 410 for the current length of the queue. The output data interval manager 406 has an output data interval counter 411 corresponding to one or more VoQs inside the input buffer 10. The output data interval manager 406 does nothing to the VoQ in which the packet has been input in the case where the segment has already existed. If the segment has not existed, the output data interval manager 406 gives an indication to the output data interval counter

411 corresponding to the VoQ so as to add 1 to the numeric value per arbitration period, and manages the output data interval time. In other words, the numerical value which the output data interval counter 411 shows indicate that how long the segment has not been transmitted from corresponding VoQs. The queue length manager 405 decreases the queue length counter 410 corresponding to VoQ which has transmitted out the segment to the crossbar switch 19. Further, the output data interval manager 406 resets the value of the output data interval counter 411 corresponding to the VoQ. Information of the queue length manager 405 and of the output data interval manager 406 is transmitted to the ARB-REQ generator 13 by way of a signal line 414. The ARB-REQ generator 13 has an ARB-REQ generating part 409 corresponding to each queue inside the input buffer 10. Respective ARB-REQ generating parts 409-1 to -4 assign some level to the corresponding queue according to information received from the ARB-REQ generator 13. When the level is assigned to the queue, a VoQ level assignment matrix 416 is referred. For the VoQ level assignment matrix 416, it is possible for a user to tune the arbiter in accordance with the characteristics of the traffics which are input to the node thereof. The level of each VoQ which has been created in the ARB-REO generator is transmitted to the arbiter 14 by way of the signal line 18. FIG. 3 shows one embodiment of the VoQ level assignment matrix 416. The level assignment matrix has a segment transfer interval 71 in a horizontal axis and the number of segments queued in VoQ in a vertical axis 72. The longer an output data interval time is and the more the number of segments queued in VoQ is, the bigger the level assigned to VoQ is. The level assignment matrix is calculated from a queue length (the number of segment in

VoQ) and the segment transfer interval. By assigning the level to the queue in this way, it comes to be possible to send within a delay time for setting arbitrarily the packet which has entered into the switch).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate in St. John's system/method the explicit steps of storing a packet to one of a plurality of hold queues and monitoring a loading condition of a transmit queue by monitoring an amount of data residing within the transmit queue; dynamically determining a time epoch based on the loading condition by (i) computing a transmission time to deliver the amount of data in the transmit queue, (ii) computing a system load in units of time by comparing the transmission time to a constant lower limit and selectively setting the system load based on the comparison, and (iii) computing the time epoch based on the system load and a previous time epoch transferring, at the dynamically determined time epoch, the packet from the one of the plurality of hold queues to the transmit queue for delivery to a network device via a downstream channel as suggested by Takase. The motivation is that (as suggested by Takase, paragraph 0016) such method provides efficient way to arbitrate between the VoQs to decide a combination of an input port and an output port, and thereby granting transmitting data to some of the VoQs by taking both an interval in sending a segment from VoQ and queue length of VoQ as parameters. Further motivation is that known work (i.e. arbitrate between the VoQs to decide a combination of an input port and an output port, and thereby granting transmitting data to some of the VoQs by taking both an interval in sending a segment from VoQ and queue length of VoQ as parameters) in one field of

endeavor (Takase prior art) may prompt variations of it for use in either the same field or a different one (St. John prior art) based on design incentives (i.e. efficient way to arbitrate) or other market forces/market place incentives if the variations are predictable to one of ordinary skill in the art.

Regarding claims 8, 28, and 37, St. John teaches further comprising: • ssociating the packet with a service flow (see paragraph 30); • identifying a service credit associated with the service flow, wherein the service credit represents a bandwidth allocation available for consumption by the service flow (see paragraph 32 quantum value); and • assigning the packet to one of the plurality of hold queues based on the identified service credit (see paragraph 32).

Regarding claims 9 and 38, St. John teaches assigning the packet comprises assigning an initial packet associated with the service flow to the transmit queue (see paragraph 30).

Regarding claims 10 and 39, St. John teaches assigning the packet comprises: • identifying a target queue state associated with the service flow, wherein the target queue state specifies a current priority level associated with the service flow (see paragraph 32 quantum value); and • selecting the one of the plurality of hold queues based on the target queue state (see paragraph 32).

Regarding claims 11 and 40, St. John teaches assigning the packet comprises: • comparing the service credit to the size of the packet (see St. John paragraph 40); and • selectively assigning the packet to the one of the plurality of hold queues based on the comparison (see St. John paragraphs 40 and 41).

Regarding claims 12 and 41, St. John teaches selectively assigning the packet comprises assigning the packet to the one of the plurality of hold queues when the service credit is greater than or equal to the size of the packet (see St. John paragraph 41).

Regarding claims 13 and 42, St. John teaches adjusting the service credit by substracting the size of the packet from the service credit (see St. John paragraph 51).

Regarding claims 14 and 43, St. John teaches selectively assigning the packet comprises: • comparing the service credit to the size of the packet (see St. John paragraph 40); and • selecting a different one of the plurality of hold queues when the service credit is less than the size of the packet (see St. John paragraph 52 and figure 4 block 475).

Regarding claims 15 and 44, St. John teaches selecting a different one of the plurality of hold queues comprises: • adjusting the service credit; and selecting the different one of the hold queues based on the adjusted service credit (see St. John paragraph 52 and figure 4 block 475).

Regarding claims 16 and 45, St. John teaches adjusting the service credit (see St. John paragraph 52 and figure 4 block 475) comprises: • defining a set of configurable service classes (see St. John paragraph 30 and 32); • pre-computing service quanta for each service class in the set (see St. John paragraph 58), wherein the service quantum represents a pre-computed bandwidth adjustment for different network loading conditions (see St. John paragraph 55-58); • associating the packet

with one of the service classes (see paragraph 32); • selecting one of the pre-computed service quanta based on the one of the service classes associated with the packet and a current network loading condition (see St. John paragraph 30-32); and • adjusting the service credit based on the selected one of the pre- computed service quanta (see St. John paragraph 49, 56, and 58).

Regarding claims 17 and 46, St. John teaches further comprising: • Identifying a target queue state associated with the service flow, wherein the target queue state specifies a current priority level associated with the service flow (see St. John paragraphs 40-41); • Adjusting the target queue state associated with the service flow to demote the target queue state by one or more priority levels (see St. John paragraph 43 sets the QoS back to zero and begins a new service round); and • Selecting the different one of the plurality of hold queues based on the adjusted target queue state (see St. John paragraph 52 and figure 4 block 475).

Regarding claims 18 and 47, St. John teaches adjusting the target queue state comprises: identifying a service class associated with the packet (see St. John paragraph 30 and 32); monitoring a loading condition of a transmit queue (see paragraph 39 quantum value of a queue is updated); adjusting the service credit based on the determined service class and the monitored loading condition (see St. John paragraphs 41-43); and selecting the different one of the plurality of hold queues based on the adjusted service credit and the adjusted target queue state (see St. John paragraph 52 and figure 4 block 475).

Regarding claims 19 and 48, St. John teaches monitoring a loading condition comprises monitoring the amount of data residing within the transmit queue (see St. John paragraph 32).

Regarding claims 21, 29, and 50, St. John teaches further comprising transmitting the packet from the transmit queue to the network device via the downstream channel (see St. John paragraph 8).

Regarding claims 22 and 51, St. John teaches transmitting the packet comprises assigning a queue state to each one of the plurality of hold queues, wherein the queue state represents a priority level for the respective hold queue (see St. John paragraphs 30-32).

Regarding claims 23 and 52, St. John teaches further comprising reassigning the queue state assigned to each one of the plurality of hold queues in response to the time epoch (see St. John paragraph 43 sets the QoS back to zero and begins a new service round where new service round corresponds to time epoch).

Regarding claims 24 and 53, St. John teaches reassigning the queue state comprises: • demoting the queue state of the highest priority one of the plurality of hold queues to the queue sate of the lowest priority one of the plurality of hold queue (see St. John paragraph 43 sets the QoS back to zero and begins a new service round), and • promoting the queue states of the remaining hold queues by a priority level (see St. John paragraph 43 if queue does not have any packets to send, QoS is set to QoS+I).

Regarding claims 54 and 60 St. John discloses system comprising: • a cable modem (see St. John paragraph 13); and • a cable modem termination system (see St. John paragraph 13) comprising: • a downstream scheduler that includes a transmit queue (see St. John figure 2 box 225 output queue), • a load monitor that monitors a loading condition of the transmit queue (see paragraph 39 quantum value of a queue is updated) by monitoring an amount of data residing within the transmit queue (see paragraph 39 the packets in that queue may be serviced by first placing them in the output queue); • a queue assignment module that stores a packet to one of a plurality of hold queues (see paragraph 5 packets enqueue in the plurality of queues and figure 2 QoS 0 Queue), and transfers the packet from the one of the plurality of hold queues to a transmit queue (see paragraph 30) for delivery to a network device via a downstream channel in response to the time epoch (see paragraph 8).

St. John implicitly teaches storing a packet to one of a plurality of hold queues and monitoring a loading condition of a transmit queue by monitoring an amount of data residing within the transmit queue; transferring, at a determined time epoch, the packet from the one of the plurality of hold queues to the transmit queue for delivery to a network device via a downstream channel, but do not explicitly teach storing a packet to one of a plurality of hold queues and monitoring a loading condition of a transmit queue by monitoring an amount of data residing within the transmit queue; dynamically determining a time epoch based on the loading condition by (i) computing a transmission time to deliver the amount of data in the transmit queue, (ii) computing a system load in units of time by comparing the transmission time to a constant lower limit

and selectively setting the system load based on the comparison, and (iii) computing the time epoch based on the system load and a previous time epoch transferring, at the dynamically determined time epoch, the packet from the one of the plurality of hold queues to the transmit queue for delivery to a network device via a downstream channel.

Takase in the same or similar field of endeavor explicitly teaches storing a packet to one of a plurality of hold queues (Figure 1, holding packets in input line processor 16-i) and monitoring a loading condition (i.e. VoQ level) of a transmit queue by monitoring an amount of data residing within the transmit queue (paragraph 0038, Each VoQ level is collected to an arbiter 14 by a signal line 18 during one arbitration period); dynamically determining a time epoch based on the loading condition by (i) computing a transmission time to deliver the amount of data in the transmit queue (If the segment has not existed, the output data interval manager 406 gives an indication to the output data interval counter 411 corresponding to the VoQ so as to add 1 to the numeric value per arbitration period, and manages the output data interval time. In other words, the numerical value which the output data interval counter 411 shows indicate (interpreted as determining step) that how long the segment has not been transmitted from corresponding VoQs), (ii) computing a system load in units of time by comparing the transmission time to a constant lower limit (figure 3, VoQ level assignment matrix 416 is referred) and selectively setting the system load based on the comparison (Respective ARB-REQ generating parts 409-1 to -4 assign some level to the corresponding queue according to information received from the ARB-REQ generator 13. When the level is

assigned to the queue, a VoQ level assignment matrix 416 is referred), and (iii) computing the time epoch based on the system load and a previous time epoch transferring, at the dynamically determined time epoch, the packet from the one of the plurality of hold queues to the transmit queue for delivery to a network device via a downstream channel (paragraphs 0042-0047, The queue length manager 405 increases the length of the segment of the input packet to the numeric value of the queue length counter 410 for the current length of the queue. the WA generator 403 transmits information of the packet which has been written in the input buffer 10 to a queue length manager 405 and an output data interval manager 406. The queue length manager 405 has a queue length counter 410 corresponding to each of all VoQs inside the input buffer 10. FIG. 2 gives the case of a 4.times.4 switch as an example. Since four VoQs exist in the input buffer 10, the queue length manager has four queue length counters 410. The queue length manager 405 increases the length of the segment of the input packet to the numeric value of the queue length counter 410 for the current length of the queue. The output data interval manager 406 has an output data interval counter 411 corresponding to one or more VoQs inside the input buffer 10. The output data interval manager 406 does nothing to the VoQ in which the packet has been input in the case where the segment has already existed. If the segment has not existed, the output data interval manager 406 gives an indication to the output data interval counter 411 corresponding to the VoQ so as to add 1 to the numeric value per arbitration period, and manages the output data interval time. In other words, the numerical value which the output data interval counter 411 shows indicate that how long the segment has not

been transmitted from corresponding VoQs. The queue length manager 405 decreases the queue length counter 410 corresponding to VoQ which has transmitted out the segment to the crossbar switch 19. Further, the output data interval manager 406 resets the value of the output data interval counter 411 corresponding to the VoQ. Information of the queue length manager 405 and of the output data interval manager 406 is transmitted to the ARB-REQ generator 13 by way of a signal line 414. The ARB-REQ generator 13 has an ARB-REQ generating part 409 corresponding to each queue inside the input buffer 10. Respective ARB-REQ generating parts 409-1 to -4 assign some level to the corresponding queue according to information received from the ARB-REQ generator 13. When the level is assigned to the queue, a VoQ level assignment matrix 416 is referred. For the VoQ level assignment matrix 416, it is possible for a user to tune the arbiter in accordance with the characteristics of the traffics which are input to the node thereof. The level of each VoQ which has been created in the ARB-REO generator is transmitted to the arbiter 14 by way of the signal line 18. FIG. 3 shows one embodiment of the VoQ level assignment matrix 416. The level assignment matrix has a segment transfer interval 71 in a horizontal axis and the number of segments queued in VoQ in a vertical axis 72. The longer an output data interval time is and the more the number of segments queued in VoQ is, the bigger the level assigned to VoQ is. The level assignment matrix is calculated from a queue length (the number of segment in VoQ) and the segment transfer interval. By assigning the level to the queue in this way, it comes to be possible to send within a delay time for setting arbitrarily the packet which has entered into the switch).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate in St. John's system/method the explicit steps of storing a packet to one of a plurality of hold queues and monitoring a loading condition of a transmit queue by monitoring an amount of data residing within the transmit queue; dynamically determining a time epoch based on the loading condition by (i) computing a transmission time to deliver the amount of data in the transmit queue, (ii) computing a system load in units of time by comparing the transmission time to a constant lower limit and selectively setting the system load based on the comparison, and (iii) computing the time epoch based on the system load and a previous time epoch transferring, at the dynamically determined time epoch, the packet from the one of the plurality of hold queues to the transmit queue for delivery to a network device via a downstream channel as suggested by Takase. The motivation is that (as suggested by Takase, paragraph 0016) such method provides efficient way to arbitrate between the VoQs to decide a combination of an input port and an output port, and thereby granting transmitting data to some of the VoQs by taking both an interval in sending a segment from VoQ and queue length of VoQ as parameters. Further motivation is that known work (i.e. arbitrate between the VoQs to decide a combination of an input port and an output port, and thereby granting transmitting data to some of the VoQs by taking both an interval in sending a segment from VoQ and queue length of VoQ as parameters) in one field of endeavor (Takase prior art) may prompt variations of it for use in either the same field or a different one (St. John prior art) based on design incentives (i.e. efficient way to

arbitrate) or other market forces/market place incentives if the variations are predictable to one of ordinary skill in the art.

Regarding claim 61, St John teaches the queue assignment module associates the packet with a service flow (see St. John paragraph 60), identifies a service credit associated with the service flow, wherein the service credit represents a bandwidth allocation available for consumption by the service flow, and assigns the packet to one of a plurality of hold queues based on the identified service credit (see St. John paragraph 58 and 60).

Regarding claim 62, St John teaches the queue assignment module assigns an initial packet associated with the service flow to the transmit queue (see St. John paragraph 30).

Regarding claim 63, St John teaches the queue assignment module further identifies a target queue state associated with the service flow, wherein the target queue state specifies a current priority level associated with the service flow, and selects one of the plurality of hold queues based on the target queue state (see St. John paragraph 43).

Regarding claim 64, St John teaches the queue assignment module adjusts the target queue state by identifying a service class associated with the packet (see St John paragraph 30), adjusting the service credit based on the determined service class (see St John paragraph 32) and the loading condition monitored by the load monitor (see St. John paragraph 49, 56, and 58), and selecting

the different one of the plurality of hold queues based on the adjusted service credit and the adjusted target queue state (see St. John paragraph 50 and 55).

Regarding claim 66, St John teaches the queue assignment module further compares the service credit to the size of the packet, and selectively assigns the packet to one of the plurality of hold queues based on the comparison (see St. John paragraph 54 and 55).

Regarding claim 67, St John teaches the queue assignment module assigns the packet to one of the plurality of hold queues when the service credit is greater than or equal to the size of the packet (see St. John paragraph 30).

Regarding claim 68, St John teaches the queue assignment module adjusts the service credit upon assigning the packet by subtracting the size of the packet from the service credit (see St. John paragraph 51).

Regarding claim 69, St John teaches the queue assignment module compares the service credit to the size of the packet and selects a different one of the plurality of hold queues when the service credit is less than the size of the packet (see St John paragraph 52 and figure 4 block 475).

Regarding claim 70, St John teaches the queue assignment module adjusts the service credit and selects a different one of the plurality of hold queues based on the adjusted service credit (see St John paragraph 49 and see figure 4 block 440, 460).

Regarding claim 71, St John teaches the queue assignment module adjusts the service credit by: • defining a set of configurable service classes (see St John paragraph 32), • pre-computing service quanta for each service class in the set, wherein

the service quantum represents a pre-computed bandwidth adjustment for different network loading conditions (see St John paragraph 58), • associating the packet with one of the service classes (see St John paragraph 30), • selecting one of the pre-computed service quanta based on the one of the service classes associated with the packet and a current network loading condition (see St John paragraph 55-58}, and •adjusting the service credit based on the selected one of the pre-computed service quanta (see St John paragraph 55-58}.

Regarding claim 72, St John teaches the downstream scheduler further includes a queue transition module that assigns a queue state to each one of the plurality of hold queues, wherein the queue state represents a priority level for the respective hold queue (see St John paragraph 30).

Regarding claim 73, St John teaches the queue transition module further reassigns the queue state assigned to each one of the plurality of hold queues in response to the time epoch generated by the load monitor (see paragraph 58 and 60).

Regarding claim 74, St. John teaches the queue transition module reassigns the queue state demoting the queue state of the highest priority one of the plurality of hole queues to the queue state of the lowest priority one of the plurality of hold queues (see St. John paragraph 43 sets the QoS back to zero and begins a new service round), and promoting the queue states of the remaining hold queues by a priority level (see St. John paragraph 43 if queue does not have any packets to send, QoS is set to QoS+l).

Regarding claim 75, St John teaches the downstream scheduler transmits the packet via a downstream channel to the cable modem (see St. John paragraphs 13, 26, and 29).

Regarding claims 76 and 77, St. John discloses methods/system comprising: • A control unit (see St. John paragraph 31) that stores packets from a variable number of service flows to one of a static number of hold queues (see St. John figure 2 QoS Queues) • storing a packet to one of a plurality of hold queues (see paragraph 5 packets enqueue in the plurality of queues and figure 2 QoS 0 Queue); • monitoring a loading condition of a transmit queue (see paragraph 39 quantum value of a queue is updated) by monitoring an amount of data residing within the transmit queue (see paragraph 39 the packets in that queue may be serviced by first placing them in the output queue); • transferring the packet from the one of the plurality of hold queues to a transmit queue (see paragraph 30) for delivery to a network device via a downstream channel in response to the time epoch (see paragraph 8).

St. John implicitly teaches storing a packet to one of a plurality of hold queues and monitoring a loading condition of a transmit queue by monitoring an amount of data residing within the transmit queue; transferring, at a determined time epoch, the packet from the one of the plurality of hold queues to the transmit queue for delivery to a network device via a downstream channel, but does not explicitly teach storing a packet to one of a plurality of hold queues and monitoring a loading condition of a transmit queue by monitoring an amount of data residing within the transmit queue; dynamically determining a time epoch based on the loading condition by (i) computing a

transmission time to deliver the amount of data in the transmit queue, (ii) computing a system load in units of time by comparing the transmission time to a constant lower limit and selectively setting the system load based on the comparison, and (iii) computing the time epoch adding the system load and a previous time epoch transferring, at the dynamically determined time epoch, the packet from the one of the plurality of hold queues to the transmit queue for delivery to a network device via a downstream channel.

Takase in the same or similar field of endeavor explicitly teaches storing a packet to one of a plurality of hold queues (Figure 1, holding packets in input line processor 16-i) and monitoring a loading condition (i.e. VoQ level) of a transmit queue by monitoring an amount of data residing within the transmit queue (paragraph 0038, Each VoQ level is collected to an arbiter 14 by a signal line 18 during one arbitration period); dynamically determining a time epoch based on the loading condition by (i) computing a transmission time to deliver the amount of data in the transmit queue (If the segment has not existed, the output data interval manager 406 gives an indication to the output data interval counter 411 corresponding to the VoQ so as to add 1 to the numeric value per arbitration period, and manages the output data interval time. In other words, the numerical value which the output data interval counter 411 shows indicate (interpreted as determining step) that how long the segment has not been transmitted from corresponding VoQs), (ii) computing a system load in units of time by comparing the transmission time to a constant lower limit (figure 3, VoQ level assignment matrix 416 is referred) and selectively setting the system load based on the comparison (Respective

ARB-REQ generating parts 409-1 to -4 assign some level to the corresponding queue according to information received from the ARB-REQ generator 13. When the level is assigned to the queue, a VoQ level assignment matrix 416 is referred), and (iii) computing the time epoch by adding the system load and a previous time epoch transferring, at the dynamically determined time epoch, the packet from the one of the plurality of hold queues to the transmit queue for delivery to a network device via a downstream channel (paragraphs 0042-0047, The queue length manager 405 increases the length of the segment of the input packet to the numeric value of the queue length counter 410 for the current length of the queue. the WA generator 403 transmits information of the packet which has been written in the input buffer 10 to a queue length manager 405 and an output data interval manager 406. The queue length manager 405 has a queue length counter 410 corresponding to each of all VoQs inside the input buffer 10. FIG. 2 gives the case of a 4.times.4 switch as an example. Since four VoQs exist in the input buffer 10, the queue length manager has four queue length counters 410. The queue length manager 405 increases the length of the segment of the input packet to the numeric value of the queue length counter 410 for the current length of the queue. The output data interval manager 406 has an output data interval counter 411 corresponding to one or more VoQs inside the input buffer 10. The output data interval manager 406 does nothing to the VoQ in which the packet has been input in the case where the segment has already existed. If the segment has not existed, the output data interval manager 406 gives an indication to the output data interval counter 411 corresponding to the VoQ so as to add 1 to the numeric value per arbitration period,

and manages the output data interval time. In other words, the numerical value which the output data interval counter 411 shows indicate that how long the segment has not been transmitted from corresponding VoQs. The queue length manager 405 decreases the queue length counter 410 corresponding to VoQ which has transmitted out the segment to the crossbar switch 19. Further, the output data interval manager 406 resets the value of the output data interval counter 411 corresponding to the VoQ. Information of the queue length manager 405 and of the output data interval manager 406 is transmitted to the ARB-REQ generator 13 by way of a signal line 414. The ARB-REQ generator 13 has an ARB-REQ generating part 409 corresponding to each queue inside the input buffer 10. Respective ARB-REQ generating parts 409-1 to -4 assign some level to the corresponding queue according to information received from the ARB-REQ generator 13. When the level is assigned to the queue, a VoQ level assignment matrix 416 is referred. For the VoQ level assignment matrix 416, it is possible for a user to tune the arbiter in accordance with the characteristics of the traffics which are input to the node thereof. The level of each VoQ which has been created in the ARB-REO generator is transmitted to the arbiter 14 by way of the signal line 18. FIG. 3 shows one embodiment of the VoQ level assignment matrix 416. The level assignment matrix has a segment transfer interval 71 in a horizontal axis and the number of segments queued in VoQ in a vertical axis 72. The longer an output data interval time is and the more the number of segments queued in VoQ is, the bigger the level assigned to VoQ is. The level assignment matrix is calculated from a queue length (the number of segment in VoQ) and the segment transfer interval. By assigning the level to the queue in this way,

it comes to be possible to send within a delay time for setting arbitrarily the packet which has entered into the switch).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate in St. John's system/method the explicit steps of storing a packet to one of a plurality of hold queues and monitoring a loading condition of a transmit queue by monitoring an amount of data residing within the transmit queue; dynamically determining a time epoch based on the loading condition by (i) computing a transmission time to deliver the amount of data in the transmit queue, (ii) computing a system load in units of time by comparing the transmission time to a constant lower limit and selectively setting the system load based on the comparison, and (iii) computing the time epoch by adding the system load and a previous time epoch transferring, at the dynamically determined time epoch, the packet from the one of the plurality of hold queues to the transmit queue for delivery to a network device via a downstream channel as suggested by Takase. The motivation is that (as suggested by Takase, paragraph 0016) such method provides efficient way to arbitrate between the VoQs to decide a combination of an input port and an output port, and thereby granting transmitting data to some of the VoQs by taking both an interval in sending a segment from VoQ and queue length of VoQ as parameters. Further motivation is that known work (i.e. arbitrate between the VoQs to decide a combination of an input port and an output port, and thereby granting transmitting data to some of the VoQs by taking both an interval in sending a segment from VoQ and queue length of VoQ as parameters) in one field of endeavor (Takase prior art) may prompt variations of it for use in either the same field or

a different one (St. John prior art) based on design incentives (i.e. efficient way to arbitrate) or other market forces/market place incentives if the variations are predictable to one of ordinary skill in the art.

Regarding claim 78, St. John discloses methods, systems and computer program products for bandwidth allocation in a multiple access system (see St. John paragraph 5) program code (see St. John paragraph 22) comprising: • a cable modem (see St. John paragraph 13); and • a cable modem termination system (see St. John paragraph 13) comprising: • a downstream scheduler that includes a transmit queue (see St. John figure 2 box 225 output queue), • a load monitor that monitors a loading condition of the transmit queue (see paragraph 39 quantum value of a queue is updated) by monitoring an amount of data residing within the transmit queue (see paragraph 39 the packets in that queue may be serviced by first placing them in the output queue); • a queue assignment module that stores a packet to one of a plurality of hold queues (see paragraph 5 packets enqueue in the plurality of queues and figure 2 QoS 0 Queue), and transfers the packet from the one of the plurality of hold queues to a transmit queue (see paragraph 30) for delivery to a network device via a downstream channel in response to the time epoch (see paragraph 8).

St. John implicitly teaches storing a packet to one of a plurality of hold queues and monitoring a loading condition of a transmit queue by monitoring an amount of data residing within the transmit queue; transferring, at a determined time epoch, the packet from the one of the plurality of hold queues to the transmit queue for delivery to a network device via a downstream channel, but does not explicitly teach storing a packet

to one of a plurality of hold queues and monitoring a loading condition of a transmit queue by monitoring an amount of data residing within the transmit queue; dynamically determining a time epoch based on the loading condition by (i) computing a transmission time to deliver the amount of data in the transmit queue, (ii) computing a system load in units of time by comparing the transmission time to a constant lower limit and selectively setting the system load based on the comparison, and (iii) computing the time epoch adding the system load and a previous time epoch transferring, at the dynamically determined time epoch, the packet from the one of the plurality of hold queues to the transmit queue for delivery to a network device via a downstream channel.

Takase in the same or similar field of endeavor explicitly teaches storing a packet to one of a plurality of hold queues (Figure 1, holding packets in input line processor 16-i) and monitoring a loading condition (i.e. VoQ level) of a transmit queue by monitoring an amount of data residing within the transmit queue (paragraph 0038, Each VoQ level is collected to an arbiter 14 by a signal line 18 during one arbitration period); dynamically determining a time epoch based on the loading condition by (i) computing a transmission time to deliver the amount of data in the transmit queue (If the segment has not existed, the output data interval manager 406 gives an indication to the output data interval counter 411 corresponding to the VoQ so as to add 1 to the numeric value per arbitration period, and manages the output data interval time. In other words, the numerical value which the output data interval counter 411 shows indicate (interpreted as determining step) that how long the segment has not been transmitted from

corresponding VoQs), (ii) computing a system load in units of time by comparing the transmission time to a constant lower limit (figure 3, VoQ level assignment matrix 416 is referred) and selectively setting the system load based on the comparison (Respective ARB-REQ generating parts 409-1 to -4 assign some level to the corresponding queue according to information received from the ARB-REQ generator 13. When the level is assigned to the queue, a VoQ level assignment matrix 416 is referred), and (iii) computing the time epoch by adding the system load and a previous time epoch transferring, at the dynamically determined time epoch, the packet from the one of the plurality of hold queues to the transmit queue for delivery to a network device via a downstream channel (paragraphs 0042-0047, The queue length manager 405 increases the length of the segment of the input packet to the numeric value of the queue length counter 410 for the current length of the queue. the WA generator 403 transmits information of the packet which has been written in the input buffer 10 to a queue length manager 405 and an output data interval manager 406. The queue length manager 405 has a queue length counter 410 corresponding to each of all VoQs inside the input buffer 10. FIG. 2 gives the case of a 4.times.4 switch as an example. Since four VoQs exist in the input buffer 10, the queue length manager has four queue length counters 410. The queue length manager 405 increases the length of the segment of the input packet to the numeric value of the queue length counter 410 for the current length of the queue. The output data interval manager 406 has an output data interval counter 411 corresponding to one or more VoQs inside the input buffer 10. The output data interval manager 406 does nothing to the VoQ in which the packet has been input

in the case where the segment has already existed. If the segment has not existed, the output data interval manager 406 gives an indication to the output data interval counter 411 corresponding to the VoQ so as to add 1 to the numeric value per arbitration period, and manages the output data interval time. In other words, the numerical value which the output data interval counter 411 shows indicate that how long the segment has not been transmitted from corresponding VoQs. The queue length manager 405 decreases the queue length counter 410 corresponding to VoQ which has transmitted out the segment to the crossbar switch 19. Further, the output data interval manager 406 resets the value of the output data interval counter 411 corresponding to the VoQ. Information of the queue length manager 405 and of the output data interval manager 406 is transmitted to the ARB-REQ generator 13 by way of a signal line 414. The ARB-REQ generator 13 has an ARB-REQ generating part 409 corresponding to each queue inside the input buffer 10. Respective ARB-REQ generating parts 409-1 to -4 assign some level to the corresponding queue according to information received from the ARB-REQ generator 13. When the level is assigned to the queue, a VoQ level assignment matrix 416 is referred. For the VoQ level assignment matrix 416, it is possible for a user to tune the arbiter in accordance with the characteristics of the traffics which are input to the node thereof. The level of each VoQ which has been created in the ARB-REO generator is transmitted to the arbiter 14 by way of the signal line 18. FIG. 3 shows one embodiment of the VoQ level assignment matrix 416. The level assignment matrix has a segment transfer interval 71 in a horizontal axis and the number of segments queued in VoQ in a vertical axis 72. The longer an output data interval time is and the more the

number of segments queued in VoQ is, the bigger the level assigned to VoQ is. The level assignment matrix is calculated from a queue length (the number of segment in VoQ) and the segment transfer interval. By assigning the level to the queue in this way, it comes to be possible to send within a delay time for setting arbitrarily the packet which has entered into the switch).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate in St. John's system/method the explicit steps of storing a packet to one of a plurality of hold queues and monitoring a loading condition of a transmit queue by monitoring an amount of data residing within the transmit queue; dynamically determining a time epoch based on the loading condition by (i) computing a transmission time to deliver the amount of data in the transmit queue, (ii) computing a system load in units of time by comparing the transmission time to a constant lower limit and selectively setting the system load based on the comparison, and (iii) computing the time epoch by adding the system load and a previous time epoch transferring, at the dynamically determined time epoch, the packet from the one of the plurality of hold queues to the transmit queue for delivery to a network device via a downstream channel as suggested by Takase. The motivation is that (as suggested by Takase, paragraph 0016) such method provides efficient way to arbitrate between the VoQs to decide a combination of an input port and an output port, and thereby granting transmitting data to some of the VoQs by taking both an interval in sending a segment from VoQ and queue length of VoQ as parameters. Further motivation is that known work (i.e. arbitrate between the VoQs to decide a combination of an input port and an output port, and

thereby granting transmitting data to some of the VoQs by taking both an interval in sending a segment from VoQ and queue length of VoQ as parameters) in one field of endeavor (Takase prior art) may prompt variations of it for use in either the same field or a different one (St. John prior art) based on design incentives (i.e. efficient way to arbitrate) or other market forces/market place incentives if the variations are predictable to one of ordinary skill in the art.

14. Claims 20, 49, and 65 are rejected under 35 U.S.C. 103(a) as being unpatentable over St. John and Takase as applied to claims 1, 8, 11, 14, 17, 30, 37, 39, 43, 46, 54, 61, and 63 above, and further in view of the background of St. John.

Regarding claims 20, 49, and 65, St. John disclose all the subject matter of the claimed invention with the exception of the queue assignment module further compares the adjusted target queue state to a lowest priority level, and drops the packet when the adjusted target queue state is less than the lowest priority level.

The background of St. John from the same or similar fields of endeavor teaches the use of dropping low priority packets (see St. John paragraph 4).

Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to use the dropping low priority packets as taught by the background of St. John in the methods, systems and computer program products for bandwidth allocation in a multiple access system of St. John in order to provide efficiency when the system is oversubscribed.

Allowable Subject Matter

15. Claims 5-6, 34-36 and 58-59 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Response to Arguments

16. Applicant's arguments, see pages 16-23 of the Remarks section, filed 12/4/2008, with respect to the rejections of the claims have been fully considered and are moot in view of new ground of rejections (upon further review) presented in this office action.

17. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SALMAN AHMED whose telephone number is (571)272-8307. The examiner can normally be reached on 9:00 am - 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edan Orgad can be reached on (571) 272-7884. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/S. A./

Examiner, Art Unit 2419

/Edan Orgad/

Supervisory Patent Examiner, Art Unit 2419